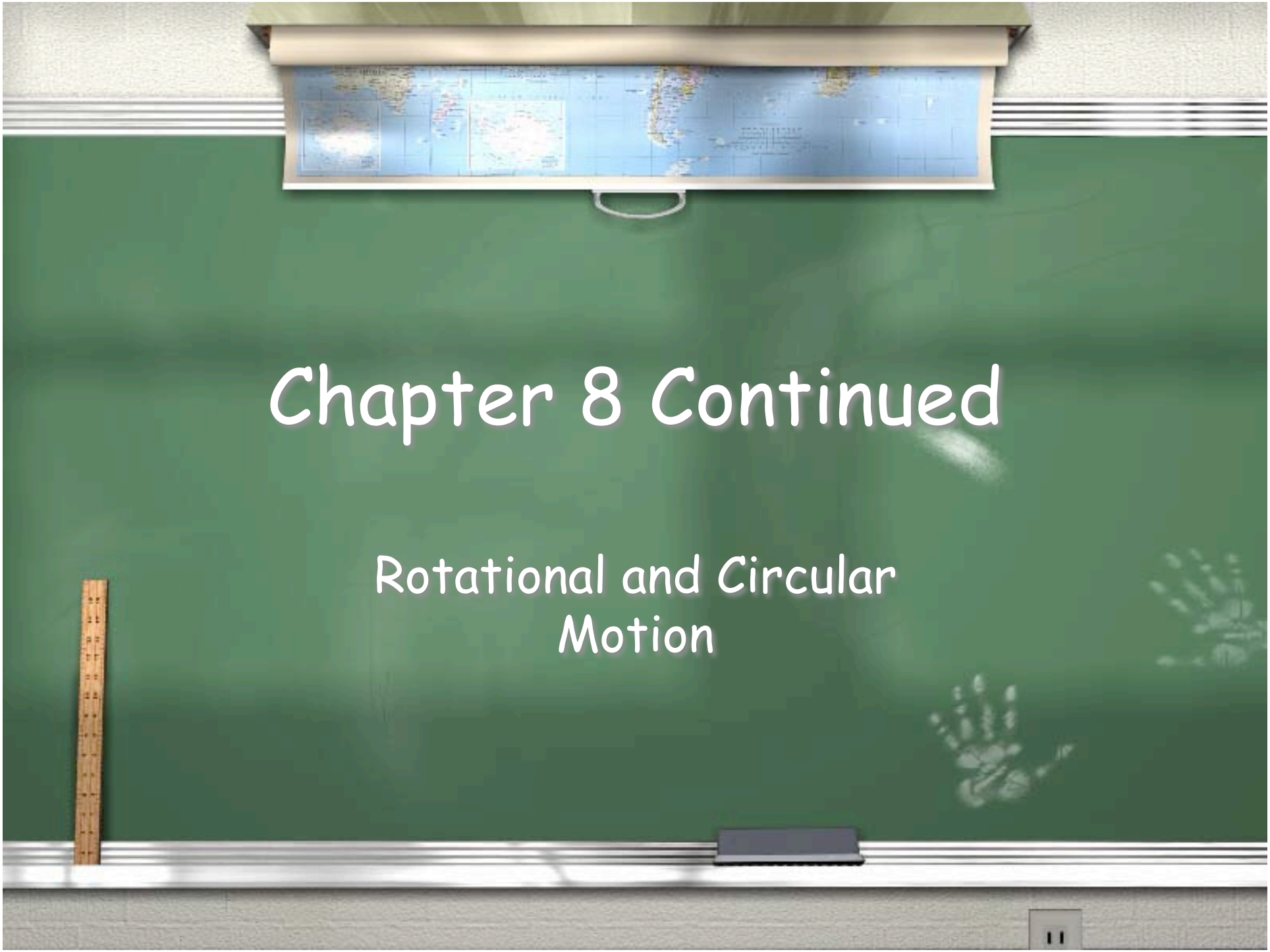

Chapter 8 Continued
Rotational and Circular Motion

Centripetal Acceleration

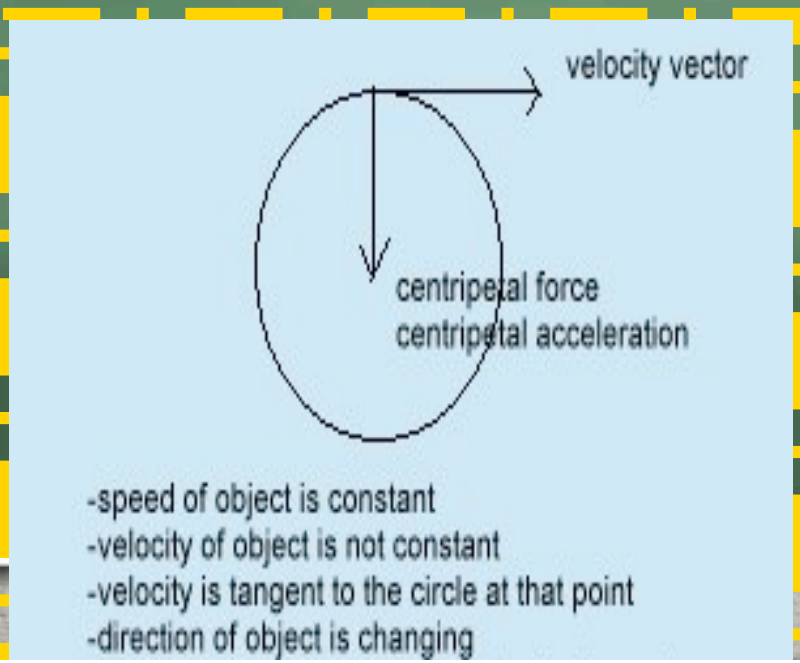
- If an object is accelerating, it is either speeding up, slowing down, or _____.
- changing direction
- Therefore if an object goes around a circular path, it must be accelerating
- We call this "centripetal acceleration"

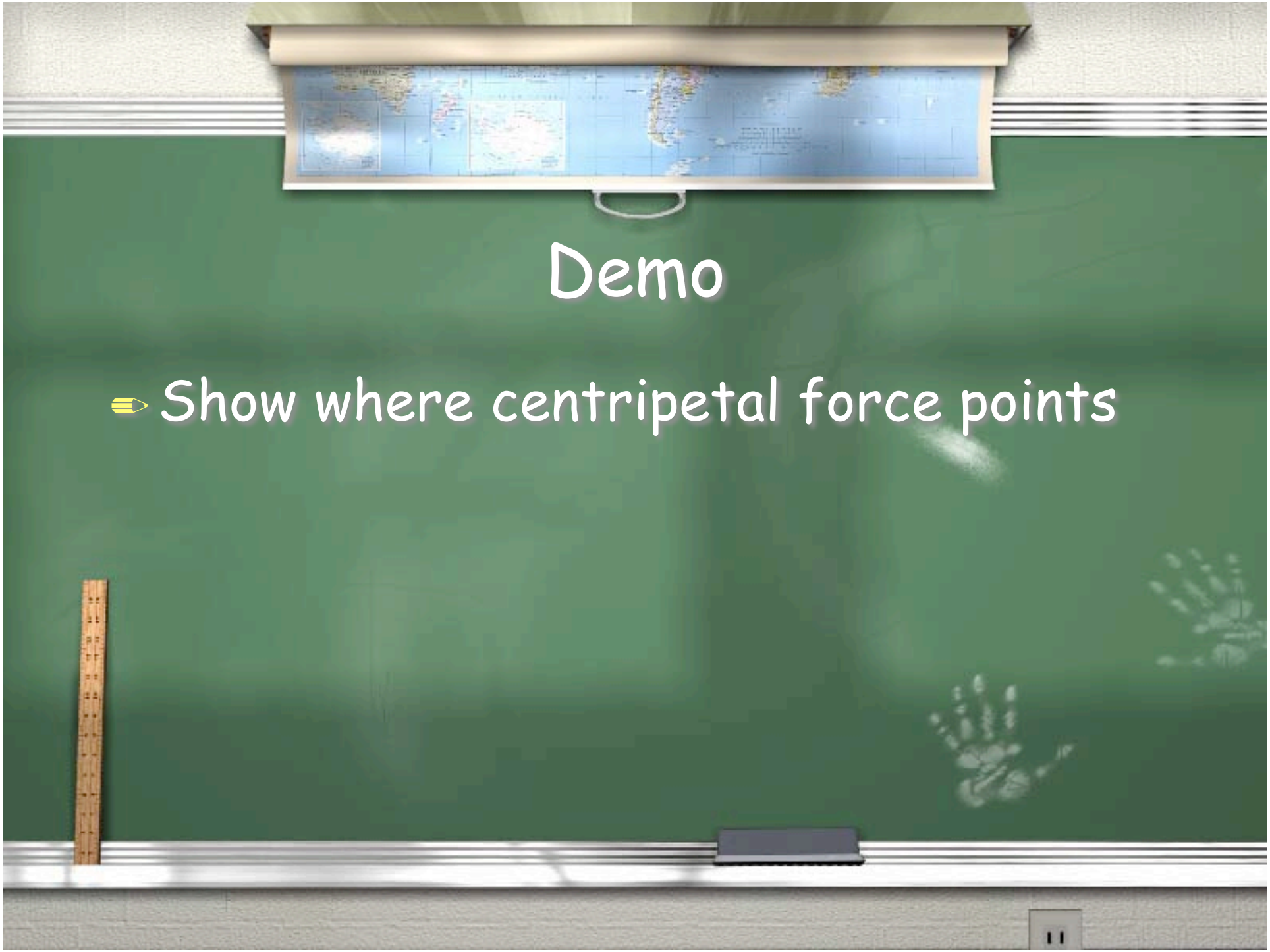
Centripetal Force

- Any object accelerating must be acted on by an outside unbalanced force. (NFL)
- Therefore, an object in circular motion has a centripetal force acting on it at all times.

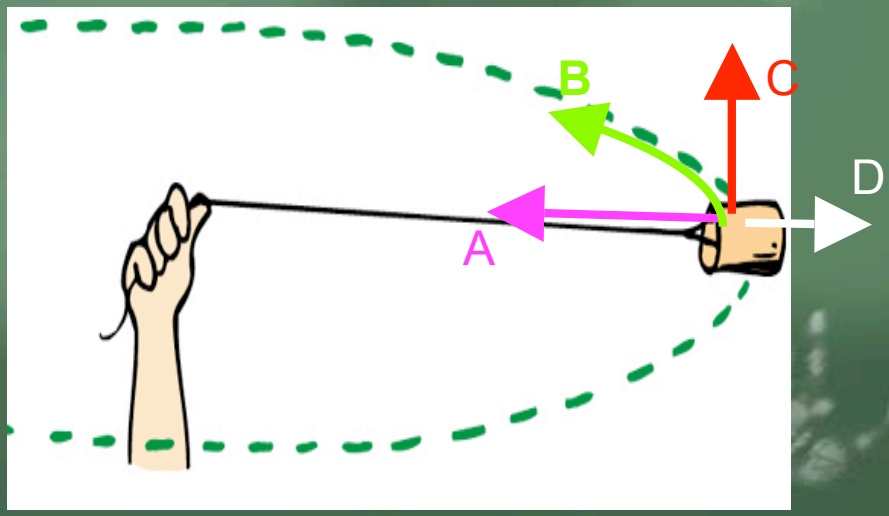
Where does centripetal force point?

- Centripetal force points toward the CENTER of the curved path!

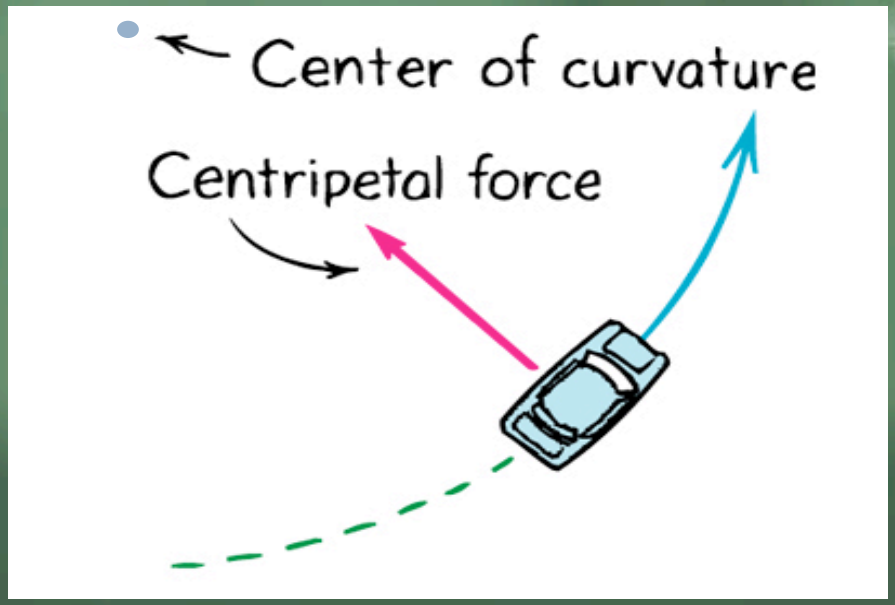



Demo
Show where centripetal force points

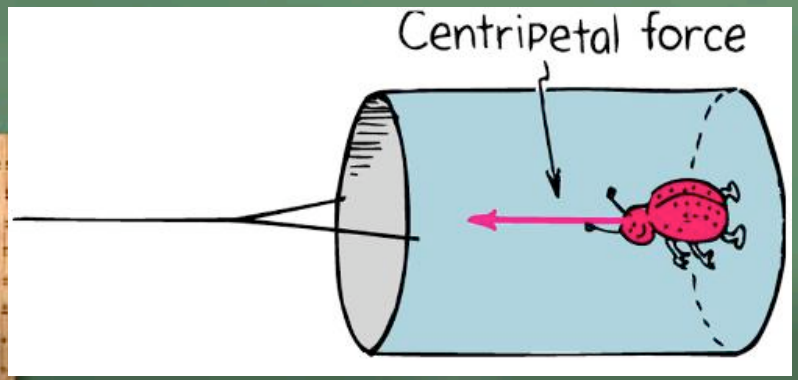
What would happen here if the string breaks?

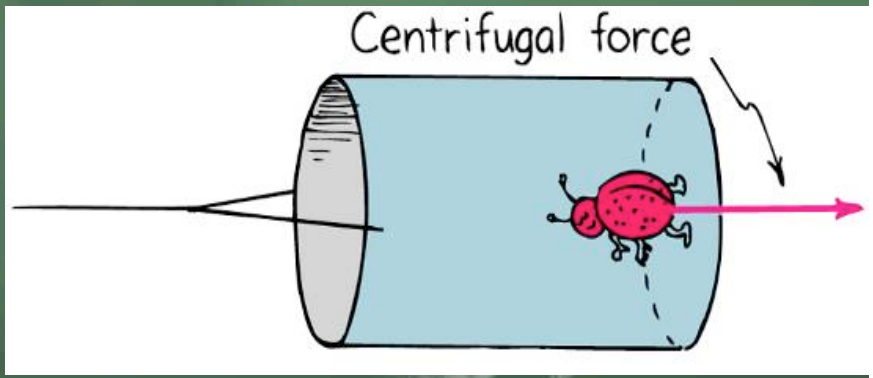


How can the car negotiate the turn?



What about centrifugal force?





Bucket demo

- Can I put a bucket full of water over my head without getting wet by rotating it fast enough?
- Forces exerted on the water by gravity plus support force of the bucket are centripetal.
- Apparent centrifugal force presses the water into the bucket.
- What really happens here?

Centrifugal Force

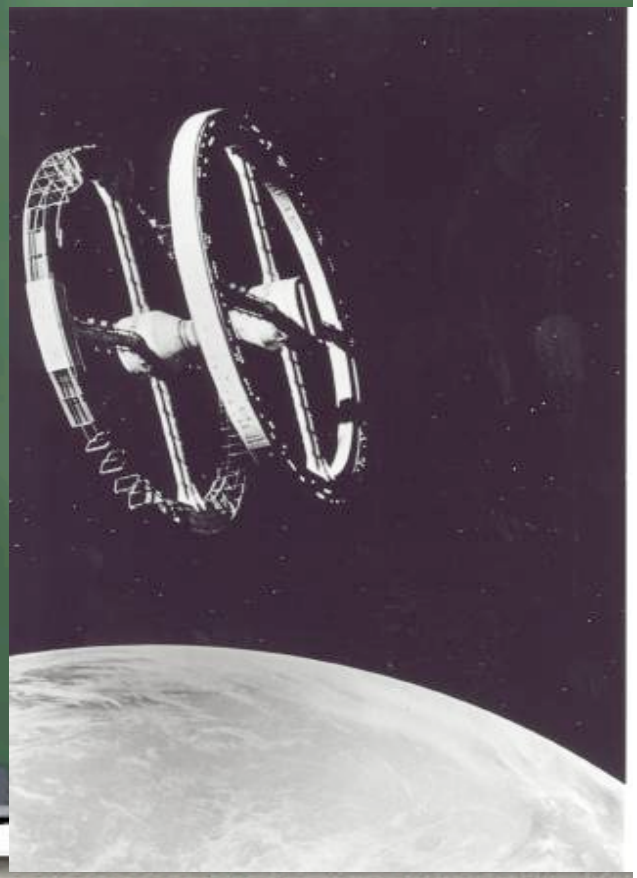
Centripetal Force

Roller coaster loops

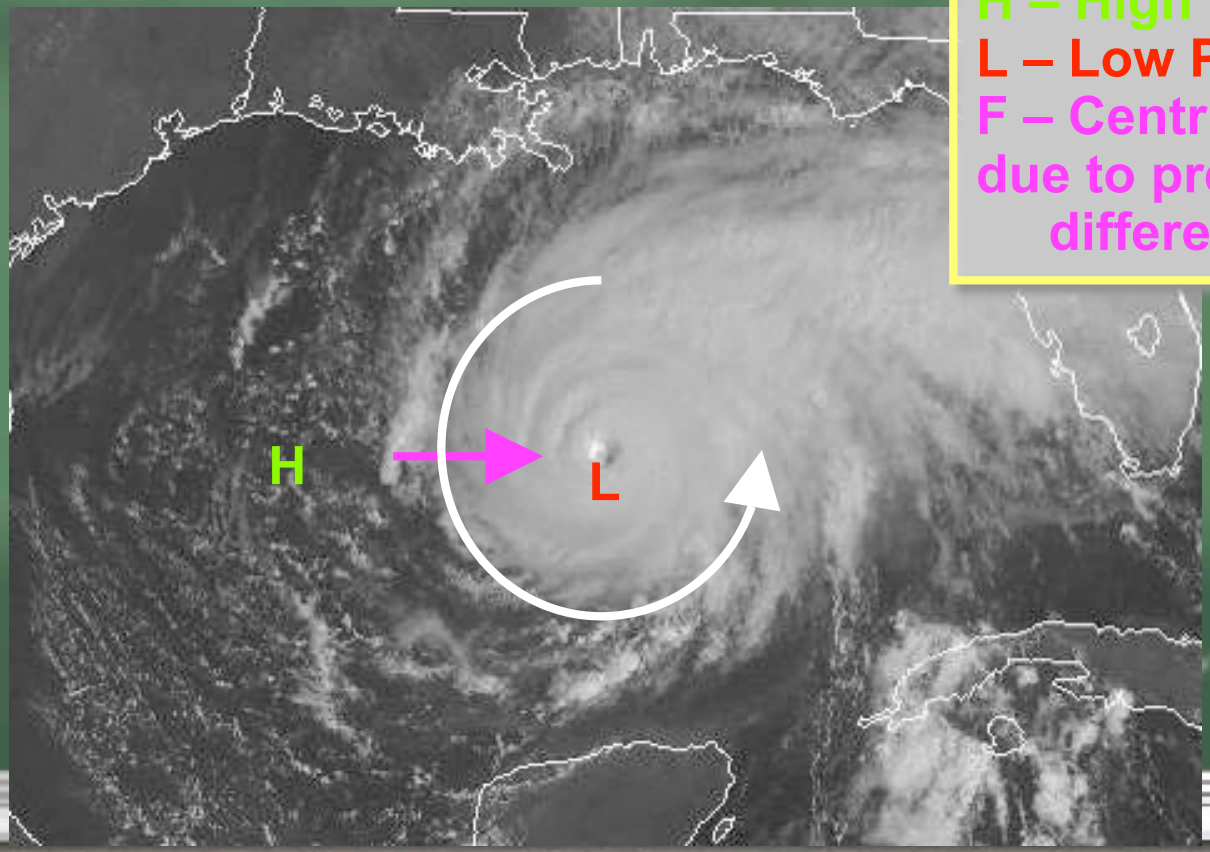
- Why don't roller coaster loops make a perfect circle?

Is artificial gravity possible?

- Centrifugal force could be used to simulate gravity in a space station.
- With the right rate of rotation a person on the outer rim would feel as if they stood on the surface of Earth.
- Scientifically accurate in the movie *2001: A Space Odyssey* (1968)

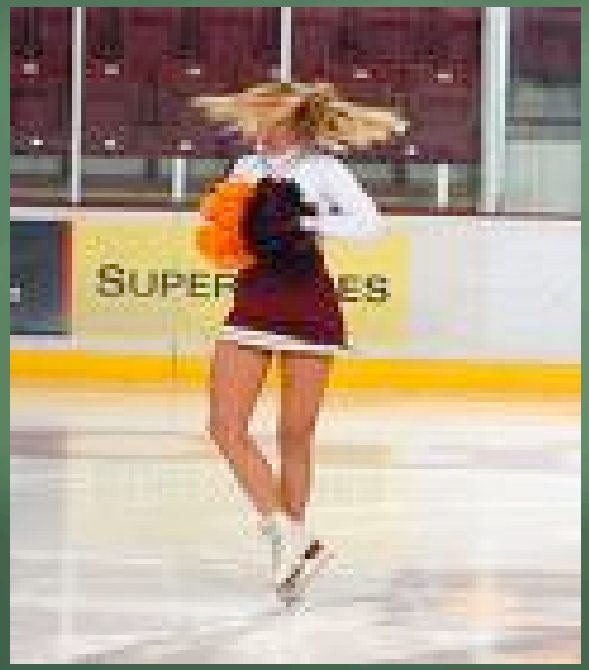


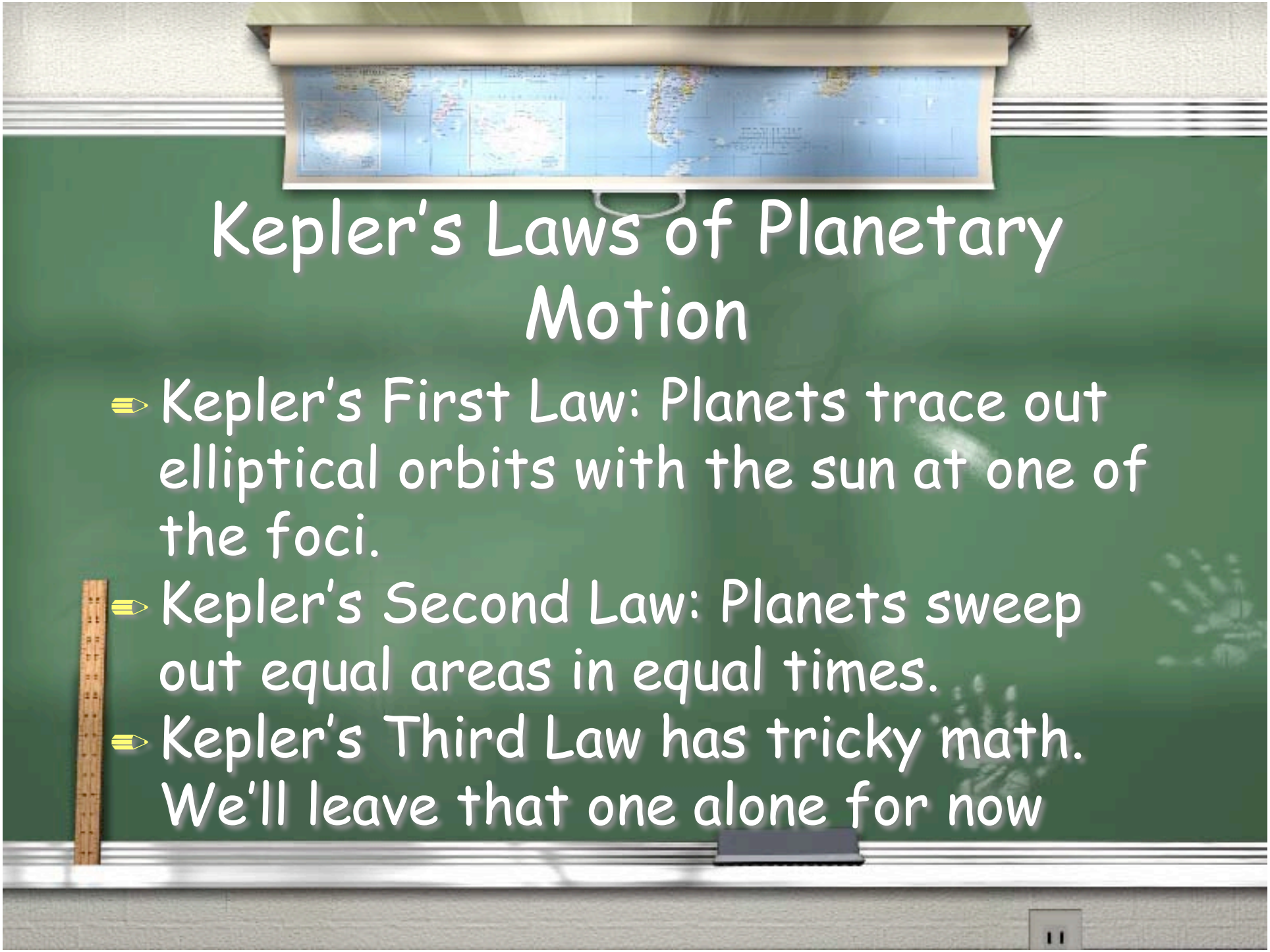
Hurricanes!



H – High Pressure
L – Low Pressure
F – Centripetal Force due to pressure difference

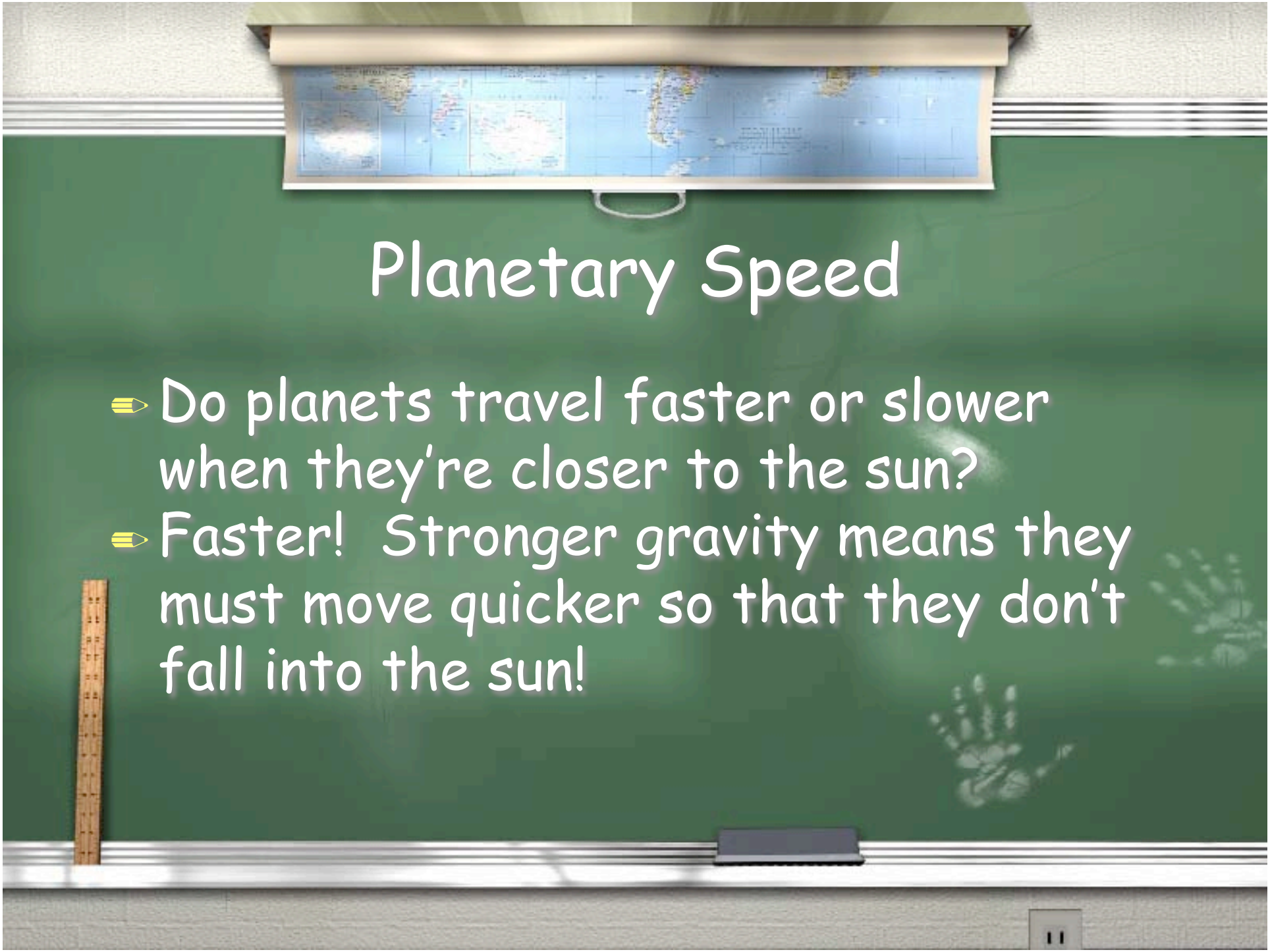
How do figure skaters control their spins?





Kepler's Laws of Planetary Motion

- Kepler's First Law: Planets trace out elliptical orbits with the sun at one of the foci.
- Kepler's Second Law: Planets sweep out equal areas in equal times.
- Kepler's Third Law has tricky math. We'll leave that one alone for now


Planetary Speed
Do planets travel faster or slower when they're closer to the sun?
Faster! Stronger gravity means they must move quicker so that they don't fall into the sun!